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ABSTRACT

This book consists of two complete units on meteorology. The first unit is created for lower elementary students and the second one is for upper elementary grade levels. The units are designed for gifted students and encourage students to be responsible for their own education. Each unit is based on an interdisciplinary approach. Suggestions for adaptation of the units are also included. (YDS)

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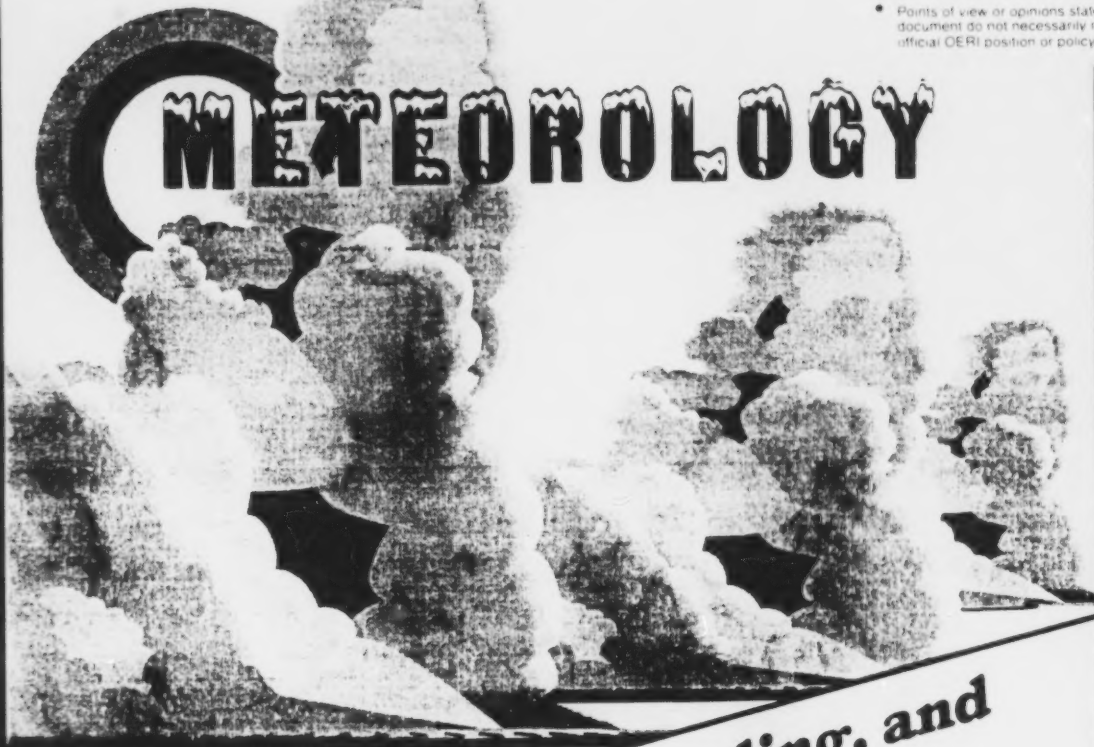
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Observing, Understanding, and
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Meteorology

Observing, Understanding, and Predicting Weather

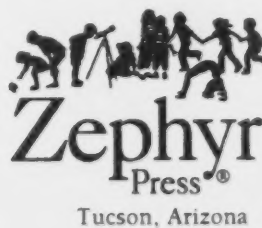
by

Mary Brown and Rosemary Dickinson

Self-directed study units
for grades K-8

Process- and product-oriented
interdisciplinary learning through:

Evaluating
Imagining
Researching
Reporting
Thinking and reacting
Mapping and charting
Creating and appreciating
Classifying and comparing
Career exploration and goal clarification



Meteorology
Observing, Understanding, and Predicting Weather

Grades K-8

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Contents

Premise	iv
Teacher's Section	
A Word to the Teacher	1
Rationale for Self-Directed Learning	2
From Passive Learner to Active Participant.....	4
The Format	5
Suggested Readings.....	6
Getting Started	7
Interest Development Center	8
To Prepare for Further Research	10
Suggestions for Adapting the Unit.....	11
Through the Chalkboard into a Tornado	12
Glossary	20
Unit I: Kindergarten through Grade Three	24
Unit II: Grades Four through Eight	40
Appendix	62
Bibliography	63

The Premise

Learning Is Natural

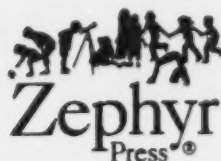
Children are active participants in their learning, not passive vessels to be filled.

They are always seeking and choosing what they will learn and what they will not learn.

Their interest, trust, and active involvement are crucial.

*Children tend to become personally involved in projects that appeal to a variety of modalities—
reading, writing, reasoning, building,
imagining, and creating.*

*What a gift we give when we respect the child's
natural need to explore, to reflect,
to communicate, to dream, to celebrate!*



A Word to the Teacher

Meteorology

Weather is easy to observe, difficult to explain, and nearly impossible to predict accurately. These characteristics make the study of weather both interesting and challenging.

For the beginning student, observations of weather can range from a simple tally of the number of rainy days in a month to a detailed, twice-daily compilation of several weather parameters.

Regardless of the level of observation and the depth of data collection, observing our universe and making sense of that universe are important for each child.

Weather is an integrated topic. Math, in the form of patterns, calculations of averages, percentiles, data collection, and graphic representation, comes into play in the study of weather. Weather also has a cultural aspect, which we see in many stories, myths, and superstitions. Our educational system in this country was for many years linked to agriculture, which is dependent on weather.

Because weather is associated with so many different sounds, music is naturally connected to the weather. Many works of fiction have a weather theme, so literature is easy to integrate into a study of weather.

We hope that as young people work through the pages of this book, they are enchanted by the children's journey through the tornado, fascinated by the knowledge provided through the self-discovery activities, and alive in their awareness of the integration of science in all aspects of their daily lives.

Rationale for Self-Directed Learning

Our children's education must be more than the memorization of capitals of states, products of countries, and dates and places of past wars. Most teachers and parents would agree that what is also wanted is for our children to learn to think for themselves, to make wise choices, to work independently, to evaluate thoughtfully the results of their study, and to use their knowledge and skills creatively.

Obstacles to Independent Learning

In spite of the teacher's best efforts, many, if not most, classroom programs involve students in schedules and organizational plans that foster dependence rather than the independence we prefer. Students are told what is to be learned and how long it will take them to learn it. The teacher not only defines the resources but also decides whether the learning experience was a satisfactory and valuable one.

A Learning Atmosphere

Each time we, as educators, focus on what our objectives are, we need to take a fresh look at our classroom mode of operation and evaluate the effectiveness of the way we teach. Quite naturally, for most of us, our teaching style has had more to do with how we were taught than with what recent research has shown about the learning process. Even our good instincts have been overcome by the years of conditioning we have known in our own educational processes.

Like a breath of fresh air, recent findings from research on the brain support our intuitive knowledge. This research shows that our brains are receptive to learning only under certain conditions. Our job is to translate that information into a classroom atmosphere that provides

- challenge
- freedom within structure
- trust and warmth
- recognition of each student's learning process
- opportunities to experience success
- personal involvement in the curriculum

A natural transition generally occurs that transforms the former "teacher-lecturer" into a "fellow learner." As fellow learner, the teacher becomes a resource person, a facilitator, and a classroom manager. In this maturing atmosphere, students gradually come to see themselves as responsible for their own learning, and a foundation for self-direction is set.

At this point, an unexpected problem sometimes arises. We find students no more ready for their independent learning than we, as teachers, were ready to allow it. This common occurrence is mentioned repeatedly in the literature dealing with programming for the gifted, an area in which independent study and research are recommended as major curricular activities. See Suggested Readings.

From Passive Learner to Active Participant

(Bridging the Gap)

The Zephyr self-directed study unit was developed expressly to bridge that gap: to transport the student from the position of passive recipient to that of an active participant in his/her own pursuit of knowledge.

Within the defined structure of each unit, students are given opportunities to

- make choices
- learn at their own paces
- learn in a manner suited to their own learning styles
- expand their research skills
- use a variety of modalities
- plan their own time
- develop the skills of creative, critical, and evaluative thinking
- experience whole-brain learning

Because assuming responsibility for directing their own learning is often an unfamiliar situation for students, they will need your encouragement at the start. Generally within six to nine weeks most students will be well on their way from teacher-dependence to self-motivation. (Beginning the venture with only a few choices, then gradually arranging the setting so that there are more and more choices works best.) As students assume more responsibility, many teachers begin to consider the school library as just another part of the classroom. Both teachers and students can benefit from the enormous resources available in most school libraries.

Eventually, a few students will be ready for a true investigative research study of professional quality as suggested by Joseph Renzulli in *Enrichment Triad Model: A Guide for Developing Defensible Programs for the Gifted and Talented*.

The Format

These units were originally developed for gifted students, but we now recognize that every child is gifted in one or more of the multiple intelligences. The units emphasize the use of higher-level thinking skills and are appropriate for use in any classroom where the goal is to encourage students to become responsible for their own education.

Interdisciplinary in content, each unit envelops a broad view of the topic by integrating the "basics" into each activity.

Within this book are two complete units: one created for the lower elementary student and one for the upper elementary student. Suggestions for adapting or adjusting either of the levels to fit any individual classroom are included.



Suggested Readings

Self-Directed Study

- Armstrong, Thomas. *In Their Own Way: Discovering and Encouraging Your Child's Personal Learning Style*. Los Angeles: J. P. Tarcher, 1988.
- Brewer, Chris, and Don G. Campbell. *Rhythms of Learning: Creative Tools for Developing Lifelong Skills*. Tucson, Ariz.: Zephyr Press, 1991.
- Clark, Barbara. *Optimizing Learning*. Columbus, Ohio: Merrill Publishing Company, 1986.
- Gallagher, James. *Teaching the Gifted Child*. 3d ed. Boston: Allyn & Bacon, 1985.
- Gardner, Howard. *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books, 1983.
- Kline, Peter. *The Everyday Genius: Restoring Children's Natural Joy of Learning*. Arlington, Va.: Great Ocean, 1988.
- Maker, C. J. *Curriculum Development for the Gifted*. Rockville, Md.: Aspen Systems Corporation, 1982.
- Malehorn, Hal. *Open to Change: Options for Teaching Self-Directed Learners*. Palo Alto, Calif.: Scott Foresman and Company, 1978.
- Miller, Ron. *What Are Schools For? Holistic Education in American Culture*. Brandon, Vt.: Holistic Education Press, 1990.
- Purkey, William, and John Novak. *Inviting School Success: A Self-Concept Approach to Teaching and Learning*. 2d ed. Belmont, Calif.: Wadsworth Publishing Company, 1984.
- Renzulli, Joseph. *Enrichment Triad Model: A Guide for Developing Defensible Programs for the Gifted and Talented*. Mansfield, Conn.: Creative Learning Press, 1977.
- Stoddard, Lynn. *Redesigning Education: A Guide for Developing Human Greatness*. Tucson, Ariz.: Zephyr Press, 1991.
- Udall, Anne J., and Joan E. Daniels. *Creating the Thoughtful Classroom: Strategies to Promote Student Thinking*. Tucson, Ariz.: Zephyr Press, 1991.

Getting Started

1. Select a topic as an extension of a regular subject (particularly when your class seems to crave more), or select a topic to pursue that is of particular interest and may not be a part of the curriculum. To zero in on special interests, administer an interest survey to each student.
2. Copy the unit for each student. When using these units for the entire class, you may want to expand or delete activities for individual students.
3. Set up a center in the classroom that encourages exploration in the subject field. You'll want to include a variety of materials. Be creative—the purpose of the center is to excite the students, so begin with lots of hands-on materials. Allow for ample browsing time and encourage students to investigate and become absorbed.
4. Go over each activity in the unit with the students, discussing and answering any questions. You, as teacher, are the key to successful implementation. Because most children are already well versed in the "One Right Answer" game, they will need encouragement to branch out into many of the open-ended activities in the packets.
5. Set the stage. Plan conferences and provide resources as needed. Then, get out of the way and let your students learn.
6. Give as much time as each student needs to complete each activity in the unit. The entire packet might take from five to ten weeks or longer.
7. As each activity is completed and evaluated, initial the activity near each number. You will want to evaluate on the basis of the response that is appropriate for each individual student.
8. When a student shows extreme interest in the topic, the completion of this unit might be only the beginning. This student may be ready for further study and research and may need only resources, guidance, and freedom to pursue his/her well-planned project.

Interest Development Center

Meteorology

The reason for an interest development center is to provide opportunities for students' interest in weather to grow. Ideally, the student should have time for self-discovery in the interest development center. These items suggested represent only the beginning. Provide students and their parents an opportunity to share their weather experiences and the center will grow. Other teachers may also have suggestions for items to contribute.

Books, magazines, posters, filmstrips, videos, and charts on the following topics:

Aerology	Lightning
Aeronomy	Lightning suppression
Acid rain	Meteorology
Agriculture	National Weather Service
Atmosphere	Natural disasters
Biomes	Ozone layer
Blizzards	Paleoclimatology
Clouds	Pollution
Cloud seeding	Radar
Climate	Satellites
Coriolis force	Smog
Environmental health	Snow
Floods	Storms
Greenhouse effect	Tornados
Hail	Volcanos
Hail suppression	Weather
Hurricanes	World Weather Watch

Local Speakers

Aviators

Farmers

Meteorologists

Navigators

Pilots

Anyone in an occupation that has need to be aware of, or is directly affected by, weather conditions

Maps

Weather maps

Satellite images

Records and tapes

Environmental sounds

Tape recorders for taping local weather sounds

Video recorder for taping class presentations and weather conditions (for example, clouds)

Tapes of local meteorological broadcasts

Items for investigation and experimentation

Data sheets for collection

Weather instruments, including barometer, thermometers (both Fahrenheit and Celsius), wind vane, anemometer, rain gauge

Models of the solar system

Local newspapers for weather data

Access to a weather radio or to the weather channel

Computer

A computer should be available for data collection and analysis.

To Prepare for Further Research

Students will need to decide:

- What will the study be? What will be investigated and produced?
- Where will the background information be found (e.g., speaker, interviews, books, film, microfiche, documents)?
- What, exactly, will be the form of the product: a model, a manuscript, or . . . ?
- Who might be interested in the product: professionals in the field, publishers, organizations, or . . . ?
- What is needed to begin: specific plans, resources, deadlines, or . . . ?

Suggestions for Adapting the Unit to Your Particular Learning Situation

- Require fewer or more research sources.
- Assign more of the activities to small groups instead of to individual students.
- Give fewer or more choices.
- Delete some activities altogether.
- Arrange the unit as a class project and have students choose different parts to complete.
- Add some activities of your own.

Through the Chalkboard into a Tornado

Mary H. Brown and Rosemary Dickinson

I listen in anger. The wind is howling. The rain is pounding. The raindrops hitting the surface come faster than the mind can comprehend. The noise increases until my brain records that the noise must be made by a much heavier substance than mere rain. It must be hail. The hail slams against the surface. Each hailstone makes an impact dent. In a few seconds we hear a noise that sounds like the engine of a large train coming directly upon us. It is so loud, so close, and with our eyes closed as tightly as possible, it is so scary.

Within three minutes the roaring sound is over. The rain begins to lessen and the howl of wind eases to a whisper. I open my eyes. The entire class claps and cheers. And, like the ham that he can be, Nathan bows low and bobs up to face us with a big grin.

His tornado presentation worked very well. The tape recorder that his uncle in Kansas put inside the TOTO (Torable Tornado Observatory) captured the storm beautifully. That presentation is actually the one I wanted to do. But now Mrs. Lucas is noting the time on the clock and asking for our attention.

"Class, we are nearing completion of our oral presentations. Tomorrow we will finish with a historical perspective and perhaps a little field trip. You are dismissed."

We walked back to our desks talking a little louder than usual. In fact, it was a regular zoo in there. Any of my other teachers would have stopped us right there and had us walk back to our seats in silence, but Mrs. Lucas is different from my other teachers. That's what most of us were talking about. She has very high expectations for us and she tells us that, too, in just those words. She says, "When teachers have high expectations, students rise to meet the challenge of those expectations."

Our principal doesn't have her figured out very well. He keeps asking her to trade in an old easel chalkboard in our classroom for a modern computer. She won't even consider it. Last month, we found out why. We had been learning about soils, and she transported us into the soil through the chalkboard. And now, we're wondering just what she has in mind for our new field experience.

For the past month in science we have studied meteorology. Mrs. Lucas assigned lots of different projects. She believes that an active mind is a learning mind, so she always has us doing something. We made all the usual weather monitoring equipment like thermometers, barometers, rain gauges, anemometers and even a sling psychrometer. We did a lot of weather observing and recording. I have a whole month of data about temperature, pressure, wind speed and direction, precipitation, and cloud types. But we

also had to do some creative writing and library research, and make models of weather systems.

We saw videos and models in bottles and boxes. We learned about **tornadogenesis**, or how a tornado starts from a **thunderstorm**. And to tell you the truth, it had me kind of scared. We have tornadoes around here every spring. The next time one passes through, I'm going to think more than once about the aftereffects. Tomorrow we are going on a field trip! What will it really be like? Do I really want to know? Tomorrow just might be the class to skip and hide out in the library. And I have extra reason to worry. The next oral report is mine.

Mrs. Lucas strongly suggested "the historical perspective on weather disasters" as my assignment. That meant that I got stuck with looking up all these facts about tornadoes, **hurricanes**, and **floods** around the country. At first it didn't sound very interesting to me. I knew it meant a lot of time doing library research, and at that time I didn't even know about things like **mesocyclones**, **droughts**, **dust devils**, **waterspouts**, and **steam devils**.

Not to mention that I was also responsible for famous **blizzards**, **ice storms**, and **avalanches**!

Even so, I worked hard on learning about the historical perspective. I researched several important natural weather disasters. I used lots of books that Mrs. Dickinson, the librarian, recommended. I have a longer list than the *Guinness Book of World Records* on natural weather disasters. I included the **Tri-State tornados** of 1925; hurricanes **Camille**, **Andrew**, and **Hugo**; the **Xenia, Ohio, tornado**; the **Palm Sunday tornadoes** of 1974; and the **Buffalo blizzard** of 1977, just to name a few. I was beginning to feel like a regular reporter of doom.

The problem is, I don't have anything dramatic to show the class like Nathan did. My report is all dry facts and numbers. Lots of numbers! Believe me, Mrs. Dickinson did her best with me. She showed me how to liven up the report a bit. I used some good descriptions of the events that I have on my list. I did my absolute best to sound lively. I even have a tape recording that my Mom helped me make of some pretend weather forecasts and warnings of these disasters. Since the federal government didn't even authorize the use of the word **tornado** in a weather warning until the 1950s, I really had to pretend. And to try to make my report a little more interesting with fewer dry facts, I will try to report some of the circumstances surrounding the storms from a survivor's viewpoint—I mean a human interest angle. The trouble is that in comparison to other reports I've seen and heard, I don't think that many people I know are going to be very interested. Not after a report like Nathan's.

And now Mrs. Lucas says we might go on a field trip, too. I'm going to be lucky to get out of this class with a good grade, let alone impress my friends. I'm even thinking of going back to the library after school to see if Mrs. Dickinson will be willing to give me some more ideas to kind of jazz it

up a little. Yeah, maybe she will help me. It'll be worth a try.

Mrs. Lucas stops me as I tried to get out the classroom door. "Are you worried about your presentation tomorrow?" I nod. Why do all the best teachers seem to be able to read kids' minds? She smiles at me. Then she closes one eye very quickly in what must be a wink. "Since Nathan left off with tornadoes, perhaps you should start your report there, and please use the old chalkboard for any terms you might need to explain."

I stare at her. She winked at me. That's weird. Proper teachers like Mrs. Lucas don't usually wink at their students. I think it might have to do with her suggestion that I put terms on the old chalkboard. Is she planning on using my presentation for a field trip? I didn't know what to think, but I'm not as confident as I like to be.

As luck would have it, Mrs. Dickinson isn't in the library when I go to see her after school. I'm going to have to stick to my presentation the way we've prepared it—kinda boring but factual.

The next day, the weather is bright and clear. It doesn't help my mood—I'm totally pessimistic about my presentation. Mrs. Lucas just looks at me and smiles. "Today, we will be looking at a historical perspective of major weather disasters. Our last presentations will focus on these topics. Before we start, I'd like to help you keep a little time perspective. We will eventually be doing a time line of major weather disasters, but I'd like to start with one of the most serious weather disasters in modern history in order to give you an idea of the ultimate magnitude of potential weather disasters. Also, in terms of real time, if all goes well, we will be returning before the time of class dismissal so that you will be able to go to your next class promptly."

What? What the heck does that mean? What are we going to do? What is that stuff about real time? What is that about if all goes well?

These thoughts go through my mind, but Mrs. Lucas just nods at me and says, "Please, you may begin, and don't forget to use the old chalkboard for your audiovisual needs."

I heave a silent sigh and somehow struggle to my feet. My classmates seem as confused as I am. They are staring at me. I think they are trying to get me to make sense of that stuff that Mrs. Lucas just said about time. But I can't. I really don't have a clue as to what she has planned. I walk slowly to the front of the classroom. I have my boom box with the tape that Mrs. Dickinson and I made. I place it on Mrs. Lucas's desk. Then I step over to take my spot next to the old chalkboard. I try to get my hands to stop shaking enough so I can read my paper. I bravely look at my classmates. Mrs. Dickinson recommends taking a deep breath to clear your head before starting. I do. I glance down at my sheet and look at the section I wrote about tornado forecasting. One more deep breath. Begin.

"Before the 1950s, meteorologists knew very little about the forecasting of tornadoes. In fact, even today the tornado is one of the most difficult storms to predict."

I hear the class gasp as the words *meteorologist* and *forecasting* magically appear on the old chalkboard. Alongside the words are definitions: Meteorologist—A scientist educated to study weather and climate; Forecasting—to estimate, calculate, and predict in advance weather patterns.

A murmur goes quickly through the class. Some kids start writing down the definitions. Others brace themselves for the next part.

Mrs. Lucas smile at me and says, "Please, continue with your general comments about forecasting a tornado and quickly—we don't want to waste time with nonessentials."

I hesitate. Mrs. Lucas is still smiling at me and clearly the class expects something. In a shaky voice I continue, "Weather maps (or synoptic charts) are something we see every day, but they were not available until after the Civil War and do not predict systems that arise quickly like tornadoes do."

I raise my head and look at my classmates. They're on the edge of their seats! I glance quickly at Mrs. Lucas and she gives me an encouraging nod. I'm not quite sure why. Nothing I have said so far is the least bit exciting. But one glance at the old chalkboard tells me. It has taken each vocabulary word and defined it as if this were an everyday occurrence.

Still shaking I continue. "Most storms are predictable through radar using Doppler techniques. Tornadoes tend to form in late afternoon and early evening in the late spring-early summer seasons with unstable air."

It's as if some switch has suddenly gone off in the room's climate control mechanism. The amount of light changes so that our bright and clear day suddenly becomes dim with evening light. Through the classroom's open window I see dark clouds headed in our direction. The room is unbearably warm. I glance around to see if anyone else notices these changes. Most of my classmates have. A few pick up slender notebooks to fan themselves. Some focus on the approaching cloud mass. I glance at Mrs. Lucas and she smiles at me with a nod to continue.

I wanted my report to be lively, but I'm sure just what Mrs. Lucas has in mind. Lively I'm willing to risk, but the idea of being part of a tornado demonstration I'm not too sure about! Still, I have to continue my report.

"One of the worst tornadoes in recorded history took place in 1925."

The classroom suddenly goes crazy, with everyone talking at once. First I notice that the old chalkboard is flashing the date 1925 on and off like a pink neon light. Then I notice that my classmates are dressed weird. Most of the boys have on pants that go just below the knee and have little straps that hold them up. Many are wearing suspenders. Their shirts are all long sleeved and have collars and ties. A few of the boys have on caps. Their hair is slicked back. Most of the girls have on knee-length dresses. Their hair is either straight and cut into a funny little-boy look or a mass of curls and ringlets.

And the strange colors! Gone are all our fluorescent pinks, bright purples, and greens. They're replaced by dull grays, blues, and blacks, with an occasional red. The clothes are all wool or cotton.

My attention is drawn next to the desks and the classroom itself. The old chalkboard looks positively new! All our desks are old, dark, and wooden with black metal seats.

Mrs. Lucas quickly silences the class. "Please continue so we may be able to dismiss on time!" she says, with extra emphasis on the *please*. The wind outside suddenly picks up speed. It is still stiflingly hot. Yet the air has an eerie calmness. I could swear that a few seconds earlier I heard birds singing. Now the silence outside is deafening.

"Please continue," Mrs. Lucas repeats softly.

Shakily, I continue, "This tornado probably began as other tornadoes do, with a thunderstorm." I'm interrupted by a flash of lightning. It lights up the whole sky. Typically, Mrs. Lucas remains cool and calm.

"Count seconds, class, until we hear the thunder. One thousand one, one thousand two, one thousand three, one thousand four, one thousand five." We all chant the numbers with her like a group of brain-dead people too panicked to think clearly. The group chant goes to one thousand fifteen, then we hear a rumbling noise from the southwest.

"Well class, can someone tell us how far away the storm is?"

Someone blurts out "3 miles," then Mrs. Lucas asks several other classmates if they agree and why. As she chats calmly to the class about sound waves and the speed of light, I continue to panic in front of the class.

Where are we? It is very clear that we are no longer at Hampton Middle School in the 1990s. As soon as Mrs. Lucas seems satisfied that everyone in the class understands the relationship between lightning and thunder and the distinction between the speed of light and the speed of sound, she focuses her attention on me. I'm still in awe of my surroundings. The storm is fast approaching. It's clear to me that we are now in the midst of the field trip experience that Mrs. Lucas referred to the day before. I'm reporting on the most deadly tornado of modern history. Now, don't you think I have reason to panic?

Somehow, Mrs. Lucas's smile and calm manner bring me back to the paper I hold in my hand. Although my voice is shaking, I continue my report.

"A typical thunderstorm that is capable of developing into a tornado is characterized by the presence of *mammato* cumulus clouds." I look up. The sky visible through our classroom windows is filled with the kind of clouds that would typically be in the midst of a thunderstorm. Yup, this storm definitely has tornado potential. Mrs. Lucas notices my hesitation. "Please continue, and quickly. We must try to match the time precisely," she says.

I continue as best I can. "The worst tornado in modern history touched a funnel cloud down first just northeast of the little town of Ellington, Missouri, and remained on the ground for a total of 219 miles."

"Good, thank you. Now we can begin," Mrs. Lucas smiles. "You may take your seat and from this point, we'll take observations."

I go quickly to the odd desk that was my place a few short minutes ago.

I hold on tight, and I'm right to do so. From that point on, the funnel cloud outside our window heads directly for us. Mrs. Lucas calmly points to the old chalkboard, which is noting barometric pressure, wind velocity, and all sorts of meteorological data.

"Marcie, please go to the window and describe the funnel," Mrs. Lucas requests as if this were just part of our routine. Marcie stands, goes trustingly to the window, and begins to talk in a shaky voice, describing what we all can see.

The funnel starts down from a distant cloud. We can see that at first it is clear, with a ghostly, white-fog appearance. But as it touches the ground, dirt and debris become mixed with the funnel. It picks up more dirt and debris as it moves along the countryside. The funnel's color gets progressively darker as it continues to pick up debris.

The storm outside is deafening now. The wind has intensified. The wind velocity on the board reads 116 kph. The Fujita-Pearson Tornado Intensity Scale has this storm rated as an FO, or in the weak category. But I've done my homework. I know by the time the night is over, it will be rated as an F4 or F5, one of the most violent storms of the century.

What I'm not prepared for is what happens next. The barometric pressure on the chalkboard suddenly starts flashing. We are experiencing an immediate drop in pressure. At the same time, the funnel that was approaching is almost directly overhead. In an instant we are looking directly up into the funnel cloud!

I just stare blankly. Everything around me is still as death. Inside the funnel there is a gassy odor, and it's difficult for me to catch my breath. There is a faint screaming, hissing sound coming directly from the end of the funnel.

The windows in the classroom suddenly begin to bow with pressure. The glass in the panes falls musically to the floor. The whole room is silent with terror. A great tearing sound comes next, as if a giant crowbar were wedging our room from its foundation. The roof raises up slightly with a gigantic shuddering noise and comes back to rest on the shaky walls. In a matter of seconds, the entire room begins to shake and roll.

In our old-fashioned room, the heavy furniture is to our advantage. The wrought-iron desks are some of the few things that don't pitch with the rock of the room. With the rest of the class, I hold tightly to my desk as I watch the walls shake while papers and books fly out the window. Lightning flashes all around us, and with one last squawk of a nail being pulled noisily from its board, the entire room begins to rise with the funnel!

The lights go out and somewhere in the room I can hear the rush of water flowing through our old-fashioned pump. I hear my heart beating wildly. I also hear the breathing of my classmates around me. As I try to calm myself with the knowledge that my friends are near me, I feel the room move and sway with the wind. It seems to me that we must be moving up. The noises

outside the room are nothing short of deafening. But above all this I hear Mrs. Lucas speaking calmly to the class.

"If you glance out the window and down to our left you can see the presence of the multiple vortices. We are now above the debris cloud. I estimate that we are between the wall cloud and the cumulonimbus cloud."

I feel anger creeping into my fear. I can't believe her. She's carrying on calmly about the parts of a tornado while we're riding in one! I keep telling myself that if she is calm, then I can be calm, too. So, after several seconds of talking to myself and telling myself not to panic, I open my eyes and glance toward the windows.

I'm close enough to a window to see that she is right. We are very high up in the tornado and traveling at quite a clip. The lightning flashing around us and below us gives a ghostly look to the objects around us. The debris is far below us, and the wind around us only looks slightly foggy. And just as Mrs. Lucas said, I can see the multiple vortices below me—each twirling around beneath us and each filled with the debris, including papers and books that were not so long ago part of our classroom.

Mrs. Lucas continues talking. As I look around me, I see that my classmates are very interested in all that is going on. In the front of the classroom, the old chalkboard still keeps track of wind speed, temperature, barometric pressure, and details of the tornado such as force, path length, and path width. The kids in that section are watching the data move across the board as if they were watching TV. Nearer the windows, most kids, like me, are cautiously looking down and around into the tornado. Only a few kids in the center of the classroom still look scared stiff. The rest of us seem to be beginning to appreciate the adventure.

"There is another weather phenomenon that is more deadly than a tornado. Does anyone wish to guess what that weather phenomenon might be?" Mrs. Lucas asks in her soft, calm voice.

"Oh, no," I think. "She'll probably have us gather in groups until we figure out the answer, or maybe she'll just ask for a signal that a certain individual has thought about the answer. Whatever way she takes to get us to concentrate and think for ourselves is going to take some time!" Time I'm not sure we have if we don't get out of this situation soon.

I really don't need to worry about it. A few seconds after she asks the question, the answer comes to Nathan in a big way. He has been brave enough to go to the window closest to me and lean over the edge for a good, long look down. Mrs. Lucas suggests to him that perhaps he had better sit down and hold on tight, that the ride might not always be smooth sailing. Suddenly the hair on the back of my neck stands straight up. I have this feeling that something's headed our way. In the same instant Nathan takes a step back and, ZAP! A huge bolt of lightning sizzles through the cloud on the exact spot Nathan has just stood. In fact, the hair on the right side of his head is singed. Understandably, he sits down in the old-fashioned bench seat,

rubs his head, and remains silent.

Within a few minutes, we must have got caught in a vortex that is beginning its descent, because we are suddenly moved in a definite circular path and slowly descending. The circles become tighter and tighter as we travel in the weakening vortex.

It seems like hours of time, but it must be less than five minutes. Suddenly, with a crash and a bang, we stop. It is just like I remember in the *Wizard of Oz*. Suddenly, all the noise of the storm is in the distance. The silence is deafening. I become aware of my classmates around me. Slowly, we all begin to stand up, look around, and view the damage. The first thing we do is marvel at the lack of any injuries. Except for the minor red burn on Nathan's scalp, we are all okay. Not a scratch or a cut on the whole bunch!

It is just like Mrs. Lucas never to forget that technically we are still in science class. Once everyone has checked for damage and hugged or high fived friends, she quickly brings us back to our senses. We are in class! What can we be thinking to get so carried away!

As soon as we are all in our assigned places and looking more or less orderly again, she asks me to continue my report.

I smile and look at Mrs. Lucas and my classmates. I know what to do next. I am going to introduce the next topic. I figure that would take us right out of this situation and right into the next storm system. I walk confidently to the chalkboard. It is still flashing weather data. Based upon the data I can see, it looks like it is going to be a decent enough day. In fact, directly outside the window is a beautiful rainbow.

Mrs. Lucas catches my arm before I can erase or write anything. She holds it firmly against the slate. "It's time to return for our next classes, or we'll be late for next hour," she says with a smile.

"Just write today's date!" I stare at Mrs. Lucas, I stare at my notes. I'm not nearly finished with all the weather disasters she asked me to research. Then I look at the class. They are wet and exhausted. Perhaps we've all had enough field experiences for one day.

While keeping my right hand fixed to the chalkboard, I awkwardly erase 1925 and replace it with the current year. To my surprise and relief a great change comes over the room. Gone are the weird clothes and hair. Back are the cool fluorescent colors. The room itself becomes neat and tidy once more without a single paper out of place. The desks are modern again without the inkwells and heavy old benches. And my classmates seem revived as they sit up and look at the sudden changes around us.

How have we done it? How have we taken a ride within a deadly tornado and returned perfectly intact and still in our science class? It's going to take me forever to figure that one out!

The bell rings. Class is over. I blink and stare at the chalkboard. I'm not certain how it was involved, but it always seems to have something to do with our field experiences!

Glossary

Meteorology

Anemometer: A weather instrument used to measure wind speed. Even a wind sock is considered an anemometer. A more advanced model would have spinning cups and a vane that respond to every wind shift.

Avalanche: Huge amounts of snow falling downhill. Commonly caused by excessive snow accumulation on slopes. The large amount of snow is made worse by snow blowing over the top and forming unstable layers, particularly on the lee side of ridges. A powder avalanche can reach speeds of two hundred mph (322 kph).

Barometer: A scale that measures the weight of the air overhead. The density of the air determines the general circulation of the atmosphere. Warm, moist air weighs less than cold, dry air. When a barometer "falls" it signals an increased chance of rain or snow.

Blizzard: A storm having low temperatures, strong winds, and large amounts of snow. Most of the snow is fine and powdery. This powdery snow is whipped by winds so that visibility is only a few yards.

Cumulonimbus clouds: In the cumulus family of clouds. These clouds are made up of thousands of individual convection cells. The top is above freezing level. Heavy downpours of rain, sometimes hail, fall from the base of cumulonimbus clouds. These clouds often have lightning and thunder discharges from cloud to cloud or cloud to ground.

Debris cloud: The section of a funnel cloud near the land surface where dust and debris rotate.

Doppler technique: A technique for measuring the speed of air moving toward or away from the radar in a mesocyclone. This method can provide as much as twenty minutes warning.

Drought: A period with lack of sufficient precipitation, which may cause crop damage, reduced water supplies, and economic hardships.

Dust devil: A small rotating column of wind caused by an unequal heating of the Earth's surface. As a dust devil moves across the surface, it picks up leaves and loose dirt.

F#: A tornado intensity rating on the Fujita-Pearson Tornado Intensity Scale.

Flood: A body of water that covers land that under usual circumstances is not under water. Rivers are susceptible to flooding when seasonal storms or snow melt causes river water levels to rise.

Force: The maximum wind speed within a storm.

Forecast: A prediction of weather based on conditions of wind, humidity, temperature, and cloud cover.

Fujita-Pearson Tornado Intensity Scale: A scale used by tornado researchers to rate the intensity of tornadoes. It was named for its creators and provides rating in three areas: force (wind speed), path length, and path width.

Funnel cloud: A cloud the extended column of which does not reach the ground. Once the cloud touches the ground, it is a tornado.

Hurricanes: Tropical cyclones. The native habitats of hurricanes are the North Atlantic and the eastern Pacific Ocean on either side of the North American continent.

Ice storms: Produced by freezing rains. Freezing rain is formed when rain falls from an above-freezing layer of air and must travel through a shallow layer of below-freezing air near the Earth's surface. The rain freezes on all objects, coating them with ice. When the layer of cold surface air is deep, the raindrops freeze as they descend and form sleet.

Mammato-cumulus clouds: A type of cumulus cloud with protrusions below. Mammatus clouds can occur only in the presence of cumulonimbus clouds. Mammatus clouds show a very moist and unstable level (middle or upper) in the atmosphere over a drier layer of air. These conditions allow for instability in the downward direction and the potential formation of funnel clouds.

Mesocyclone: A small cyclonic circulation of air that can form a tornado. Mesocyclones are about ten miles in diameter and contain small cold air and warm air currents. These different temperature currents can interact to form a tornado.

Meteorologist: A scientist who studies weather, the atmosphere, and weather patterns.

Meteorology: The science of weather, the atmosphere, and weather patterns.

Path length: One of the characteristics by which tornadoes are classified. Path length is expressed in miles per hour.

Path width: One of the characteristics by which tornadoes are classified. Path width is expressed in either yards or miles.

Precipitation: Water in any form that falls from clouds.

Pressure: The weight of the atmosphere on a certain unit area such as a square centimeter.

Radar: An instrument that sends out radio waves and then receives them back after they have been reflected off an object. Radar is used to help detect tornadoes and other storms.

Rainbow: An arc containing the colors of the light spectrum. It is produced by the refraction, reflection, and scattering of sunlight that passes through mist or raindrops.

Rain gauges: Instruments that collect and measure the amount of precipitation. To increase accuracy the opening of the container should measure ten times the size of the measuring container.

Sling psychrometer: A type of hygrometer (instrument to measure the amount of water vapor in the air). A sling psychrometer consists of two matched thermometers, a wet bulb and a dry bulb, mounted together. The wet bulb is covered by a muslin cloth that has been moistened. The two thermometers are whirled in the air and the wet bulb thermometer is cooled by the evaporation on the cloth. The drier the air, the greater the evaporation from the cloth and the lower the wet bulb reading. The dry bulb simply measures air temperature. Both temperatures compared to standard tables can show relative humidity readings.

Sound waves: Vibrations of molecules that may be detected by nerves in the human ear and interpreted by the brain as sound. Sound travels at different speeds depending on the substance it is traveling through.

Speed of light: 186,000 miles per second is the speed at which light (a form of radiant energy) travels.

Speed of sound: Sound waves can travel through water, metal, or any other material, but not through a vacuum. The speed of sound depends on the material through which it is traveling. Sound travels faster through water (4,920 feet/second) than air (1,150 feet/second).

Steam devil: A small, usually short-lived whirl seen over warm water with overlying cold air. Steam devils are more frequent in winter over lakes.

Synoptic charts: Weather maps assembled by weather observers. The weather stations simultaneously observe and report weather four times each day.

Temperature: The amount of heat energy.

Thermometer: An instrument to measure heat content. A thermometer uses the principle that fluids expand when heated and contract when cooled.

Thunderstorm: A weather system with the potential for a great variety of activity. Thunderstorms involve warm, moist unstable atmosphere. Warm air rises and continues to rise as it remains warmer than the surrounding air. Such a situation has great potential for instability.

Tornado: A violently twisting column of air that comes from a cloud to the ground. Tornadoes sweep the ground of all movable objects and send dangerous debris flying in all directions.

Tornadogenesis: Refers to the conditions and mechanisms that cause tornadoes to form. Tornadoes are usually formed within thunderstorms.

TOTO (Torable Tornado Observatory): The name given by the University of Oklahoma and National Severe Storms Laboratory to an exceptionally sturdy instrument package. Researchers set TOTO in the path of mesocyclones to determine surface conditions such as winds, temperature, pressure, and electric fields within the tornado.

Unstable air: A mass of air that is moving over a surface warmer than itself. The air becomes warmed by its contact with the earth. The warm, light air rises through the cold air above. This air may produce cumulus clouds and thunderstorms.

Vortices: Masses of air that rotate, either clockwise (anticyclonic) or counterclockwise (cyclonic). Tornadoes may have multiple vortices. These columns of air extend downward and form cumulonimbus clouds.

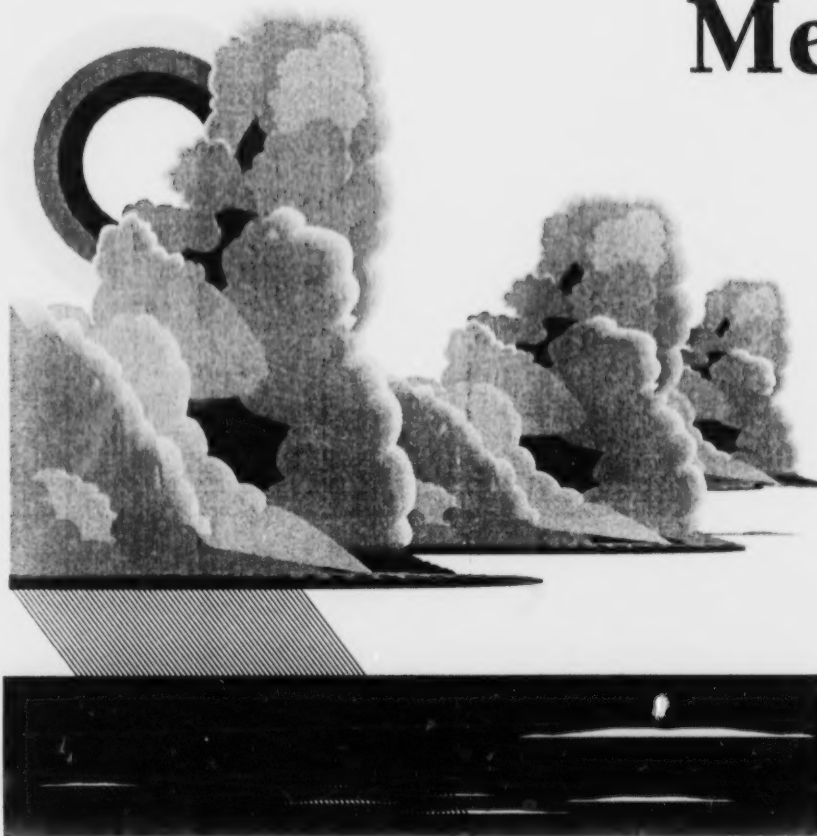
Wall cloud: The base of the cumulonimbus cloud from which the funnel cloud extends. It is also the top of the funnel cloud as it flares into the cumulonimbus cloud.

Waterspout: A rapidly rotating column of air that begins over water and is similar to a tornado. Strong waterspouts are tornadoes that form over a river, lake, or ocean. The majority of waterspouts are less intense than tornadoes and break apart when they pass from water to land.

Weather maps: Summaries of data collected from weather stations and compiled by central weather stations. Surface charts and upper air charts are the two types of weather maps. Surface charts show information such as wind direction and speed, temperature, dew point, current weather, amount and type of clouds, and precipitation, using symbols all within a space the size of a dime.

Wind direction: The general area that air in motion moves from. Wind direction can tell you what kind of weather is heading your way. Wind direction can be determined by a wind vane, a windsock, or a kite, among other instruments.

Wind speed: Measurement of how fast or slow air is moving. Wind speed is often measured by the Beaufort scale, which uses wave height on water, or by using the land version of measuring the angle of a smoke plume. Anemometers are also used to measure wind speed with accuracy.



Meteorology

Observing,
Understanding,
and Predicting
Weather

Name _____ Date _____

Unit 1

1. Setting the Stage

Close your eyes and imagine you are outside and it is raining. What does it feel like? What do you hear? What do you smell? Now imagine you are on a beach on a sunny day. What do you hear? What do you smell? What do you see? Think of the many different kinds of weather. Do you have a favorite kind of weather or do you like many different kinds?



2. Weather Poems

*There was a small boy of Quebec
Who was buried in snow to his neck.
When they said, "Are you friz?"
He replied, "Yes I is,
But we don't call this cold in Quebec."*

attributed to Rudyard Kipling

- * Write a poem about weather in your part of the country. It might be a limerick, a haiku, or a name poem.

or

- * Write a poem about a storm. Use words that tell about the sounds of a storm.



3. Vocabulary

Find out what the following words mean:

Tornado

Hurricane

Flood

Rainbow

Sleet

- * Make a picture book showing each kind of weather. Tell a friend about each one.

or

- * Make a mobile showing each of these kinds of weather.



4. Measuring Weather

Did you know that people measure different kinds of weather?
Find out about the following instruments people use to measure:

Barometer

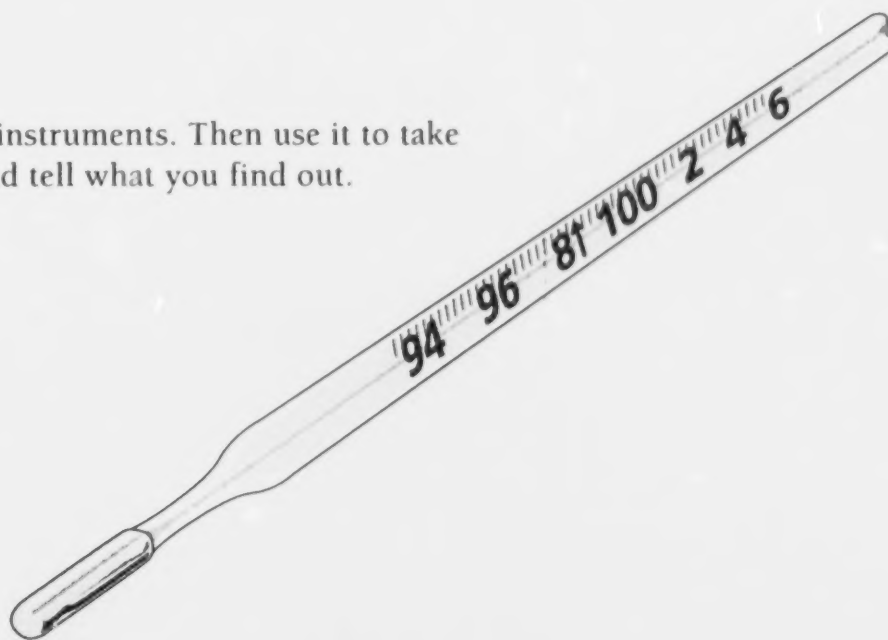
Thermometer

Sling psychrometer

Rain gauge

Anemometer

- * Try making one of the instruments. Then use it to take some measurements and tell what you find out.



5. Weather Stories

Find out about some famous storms.

- * Make up a play about the tornado of 1925 or another tornado. *or*
- * Pretend you are an animal in a storm. Write a story about the storm. *or*
- * Pretend you are in a flood. Write a diary for one week of what happens.



6. Musical Weather

- ✿ Make some music of a storm. You could have drums for thunder. You could make a rain stick from a cardboard tube, aluminum foil, and some rice. Think of other instruments and other sounds for your storm. You might even try making different kinds of storms. Does hail sound different from heavy rain?

or

- ✿ Create some music to tell about other kinds of weather. What music makes you think of a blizzard? What music makes you think of a spring day?



7. Posters

- * Did you know that there are names for different kinds of clouds? Find out about the different kinds of clouds. Then make a poster showing cloud types. You could use travel magazines or posters to get some pictures. Label the different types of clouds.

or

- * Find out what *precipitation* means. Make a poster showing different kinds of precipitation. Include *liquid* and *solid* kinds of precipitation. Label the different types of precipitation.

or

- * Make a poster showing the types of rainbows. Label each type.



8. Models

Choose one of the following:

Flood

Hurricane

Tornado

Blizzard

- * Build two models or dioramas. One should show an area before the storm and one should show the area after the storm. If you lived there, what might you do if a storm were coming? ☆



9. Forecast

Find out what *forecast* means. What are some ways that people forecast weather?

- * For one week, try guessing what the weather will be like the next day. Write down your guess the day before. Then at the end of the next day write what the weather was like. How many times were you right? What were some of your reasons for your guesses?



10. Mapping

Find out where some famous storms have happened. Then use an outline map of the world to show ten famous storms.

- * Make up a picture book, song, or dance about one of them.

or

Listen to a radio weather report on the TV or radio. Look in a newspaper for a weather report. What kinds of words do they use to tell about the weather? What kinds of symbols?

- * Use weather symbols to make a weather map about the radio or TV report.

The World — Mercator Projection

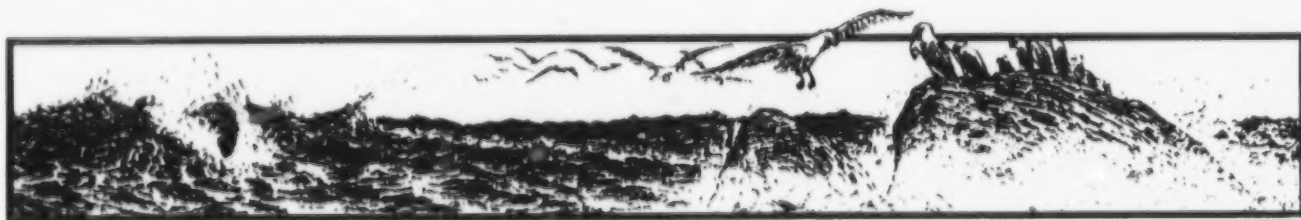


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11. Natural Disasters

What do you think happens to trees and other plants after a big storm?
What happens to animals? Make some guesses, then see if you can
find out.

- * With a friend, present an interview to your class. One of you
can be a plant or animal. The other can be the interviewer.
Tell what happens after a flood or a hurricane.



12. Weather Games

Find out some facts about weather.

- * Make up a game about weather and play it with friends.

or

- * Present weather skits to the class. Have people guess what types of weather you are showing.

or

- * Make up some weather jokes and riddles. Tell them to your friends.



13. Unusual Weather

Have you ever heard of snow rollers, sea smoke, virga, or halos? Find out what they are.

- * Make a picture book, a song, or a dance to tell about them.

or

Did you know there are some unusual names for weather? Have you heard of haboob, cow-killer, dog days, backing wind, gully-washer, and plow wind? Find out where these names came from.

- * Make up six of your own names. Have someone guess what kind of weather your names are for.



14. Building and Weather

Have you ever heard of bridges blowing down in a storm? What else might happen to a bridge? What could happen to a tall building? A house? What do people have to think of when they are building something? What are all the things you might have to think of if you are building a bridge?

- * Make a model of a bridge that you think would be strong in many kinds of weather.

or

Find out about the Tacoma Narrows Bridge.

- * Tell your class what happens to it in different kinds of weather. If you think it should be fixed, tell what you would do.



15. Meteorologists

Find out what a *meteorologist* is.

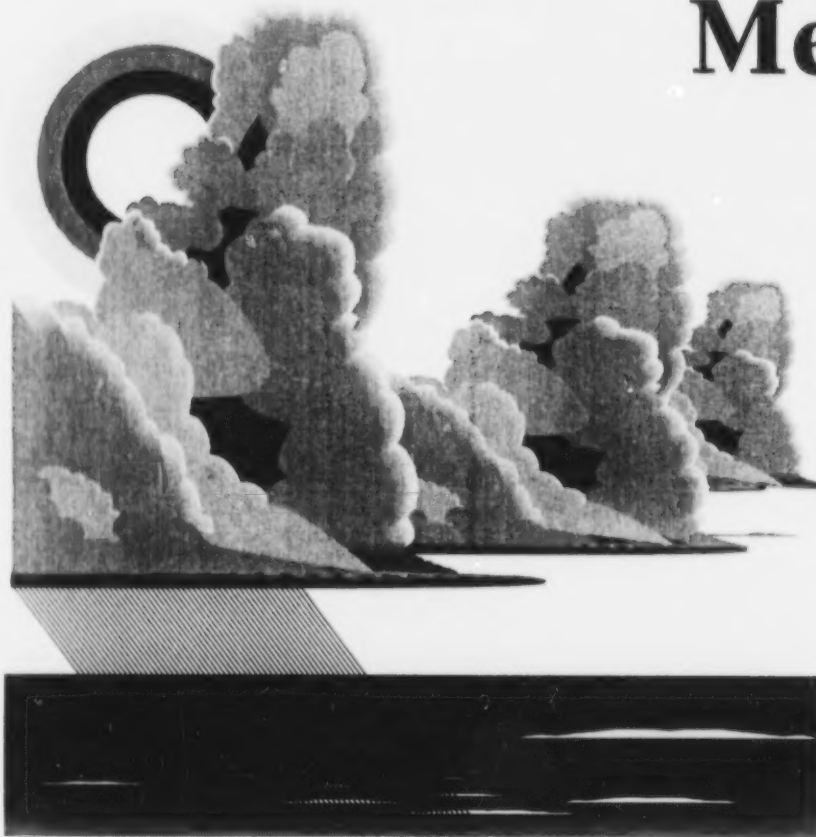
- * Make a poster showing what a meteorologist does.

or

What jobs have a lot to do with the weather? Do you think pilots, road crews, and sailors pay attention to the weather? Who else can you think of?

- * Make up a song, story, or puzzle about someone who pays a lot of attention to the weather.





Meteorology

Observing,
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Name _____ Date _____

Unit 2

1. Weather Poems

*There was a small boy of Quebec
Who was buried in snow to his neck.
When they said, "Are you friz?"
He replied, "Yes I is,
But we don't call this cold in Quebec."
—attributed to Rudyard Kipling*

- * Write a poem about weather in your part of the country. It might be a limerick, a haiku, or a name poem.

or

- * Write a poem about a storm. Use words that describe the sounds of a storm.



2. Weather Stories

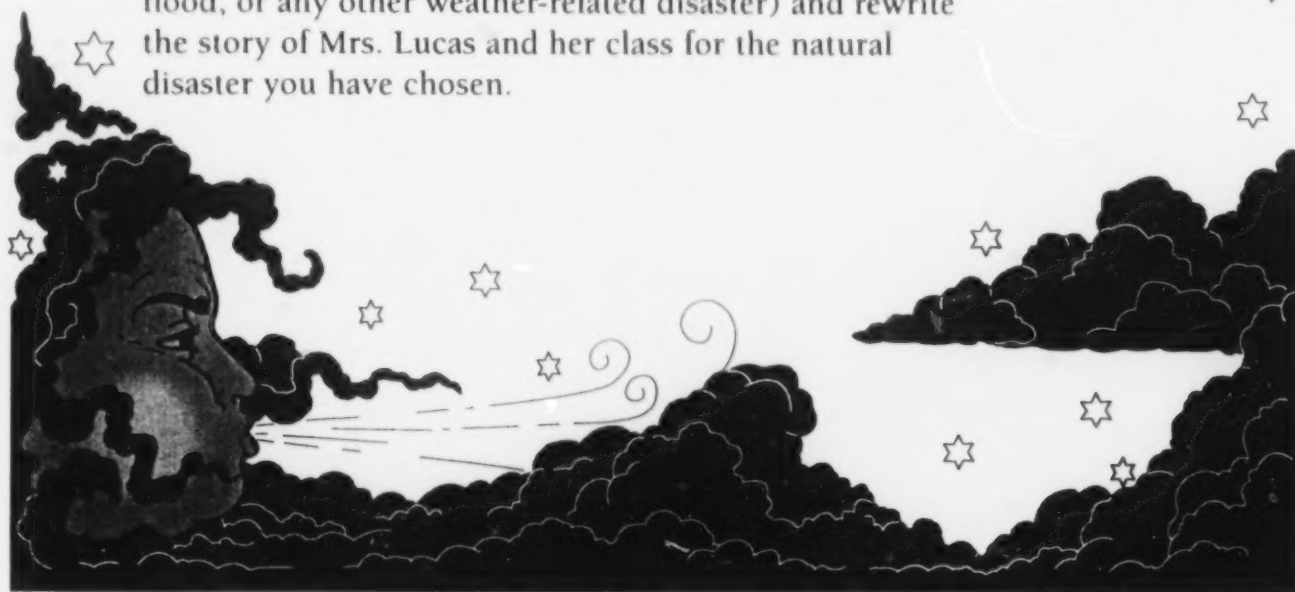
- * Write a play about the tornado of 1925 or any other severe tornado.

or

- * Write a storm story from the point of view of a child.

or

- * Choose another infamous natural disaster (a hurricane, flood, or any other weather-related disaster) and rewrite the story of Mrs. Lucas and her class for the natural disaster you have chosen.



3. Word Search

Do the following word search. The words hidden in the puzzle are listed below.

Q F T J B E H C N A L A V A D P R K D S
 T H M T S H O W E R S U W O E S C R Q B
 V T T Z F Y Y A T M S R O B X R A Z V W
 C Y H N M Q J E B D E L R M O Z Q N R F
 G E E Q V E L C R A F T C V Z H H B S Q
 X F R M E Y R O M M R K E I C G A O W J
 E X M P M C U T K R E O L O N Y Q I H F
 X W O U R G I N C V O B M I R R R R L Z
 G M M K H E Q X U U X T T E E O A K P W
 J B E T E U C D J Y M S S T T O L X N Y
 F I T R M N S I T I A U E R D E G O H W
 R M E B L N A L P C U M L A E W R S G K
 X R R G O Z A C E I O E N O U D D V Q Y
 A J Y W O M O R I M T R D J N U N I G I
 U A N U D E O W R R O A V D O I D U I J
 W E Q J E F M E M T R W T L Z R M G H S
 F P V I U D N V W U L U C I Y I D B O T
 P N D X V A L T G L U Q H D O I U V U B
 F K M E S O C Y C L O N E L I N N M P S



Anemometer
 Avalanche
 Barometer
 Blizzard
 Clouds
 Cumulonimbus
 Drought
 Flood
 Forecasting
 Hail
 Hurricane
 Ice
 Mesocyclone
 Meteorology
 Precipitation
 Showers
 Snow
 Thermometer
 Thunderstorm
 Tornado

or * Choose some words from the glossary section and write your own word search.

or * Using a sheet of graph paper and some words from the glossary, design your own crossword puzzle.

4. Computer Story

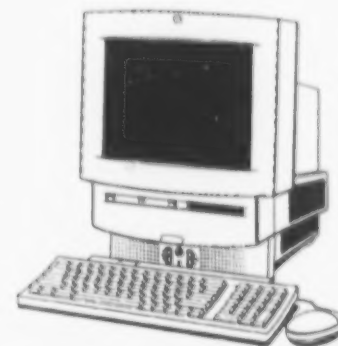
- * Write a computer program to show storm safety to children younger than you are. It could be a drill-and-practice with weather safety facts or a scenario with choices

or

- * Type the following program into qBasic and edit it to fit your needs.

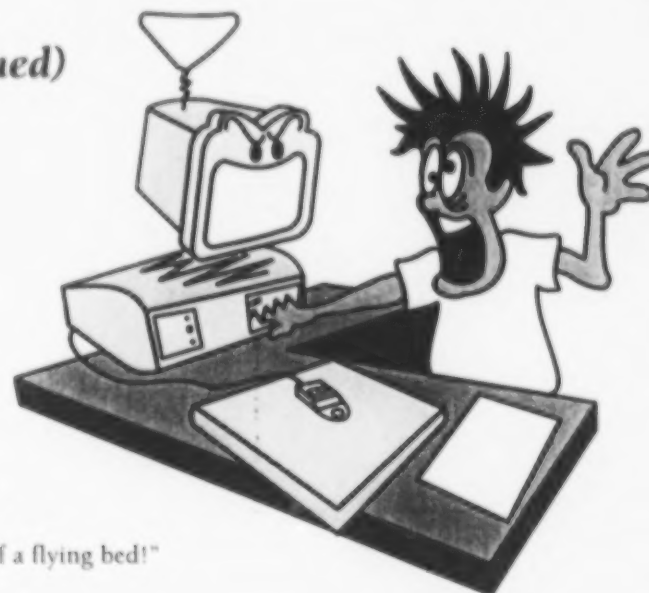
Weather Computer Program

```
5 rem Tornado.bas; tornado computer program
10 CLS
20 PRINT "You are reading your favorite science fiction book . . . "
30 PRINT "When you hear the tornado siren scream!"
40 PRINT
50 PRINT "THINK FAST!"
60 rem The following section shows player the possible choices.
70 PRINT
80 PRINT "Do you . . . "
90 PRINT "(1) Choose to continue reading and ignore the warning?"
95 PRINT
100 PRINT "(2) Choose to take cover under your bed?"
105 PRINT
110 PRINT "(3) Go as quickly as possible to your basement and take cover!"
115 PRINT
120 PRINT "Type in your choice and press enter!"
130 Input choice
```



4. Computer Story (Continued)

```
140 IF choice = 2 THEN GOTO 220
150 IF choice = 3 THEN GOTO 260
160 IF choice <> 1 THEN GOTO 60
170 rem : choice 1 ignore
175 PRINT
180 PRINT "NOT a wise choice!"
190 PRINT "You might get lucky this time but,"
200 PRINT "then again, you might NOT!"
210 END
220 rem: choice 2 - under the bed
225 PRINT
230 PRINT "Not a bad choice, but not the best."
240 PRINT "You might be left dangling from the leg of a flying bed!"
250 END
260 rem: choice 3 - basement
265 PRINT
270 PRINT "SMART CHOICE! If the tornado takes your house away, at least"
280 PRINT "you stand a chance of crawling out of the rubble!"
290 END
```



Based on a program from *Building with Basic: A Programming Kit for Kids* by Gayle Arthur

5. Musical Weather

- * Combine your imagination, your creativity, and your musical ability to make music representing a storm. Drums could represent thunder. You could make a rain stick from a cardboard tube, aluminum foil, and some rice. Think of other instruments and other sounds for your storm. You might even want to start a series of different storms. Does hail sound different from heavy rain?

or

- * Create some environmental music to represent other weather phenomena. What music makes you think of a blizzard? What music makes you think of a spring day?



6. Posters

- * Create a poster showing cloud types. You might wish to use travel magazines or travel posters as a source for the cloud pictures. Label the different types of clouds.

or

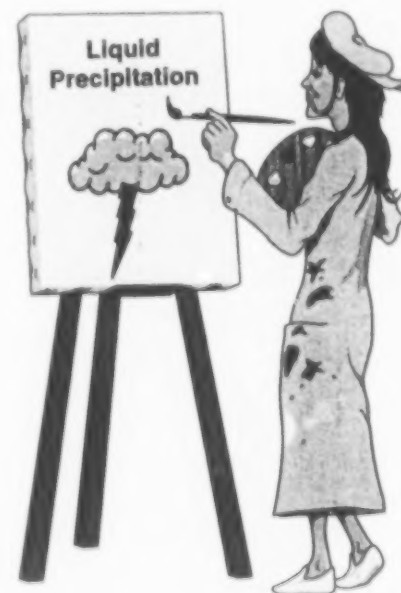
- * Create a poster showing various types of precipitation. Include the various types of liquid and solid precipitation. Provide a key to show the reader the weather term for each illustrated type.

or

- * Create a poster showing tornadogenesis. Carefully illustrate the sequence of events that form funnel clouds.

or

- * Create a poster showing the types of rainbows. Label each type.



7. Models

- * Build a tornado model. (There are commercially available tubes that will allow you to connect two liter soda bottles and simulate tornado action by creating a vortex.)

or

- * Build two dioramas of equal size and scale. Have one show houses and property before a tornado and the other show houses and property after a tornado. Compare the two dioramas and prepare a presentation that would be suitable for a younger child—factual, yet not too scary.



8. Weather Time Lines

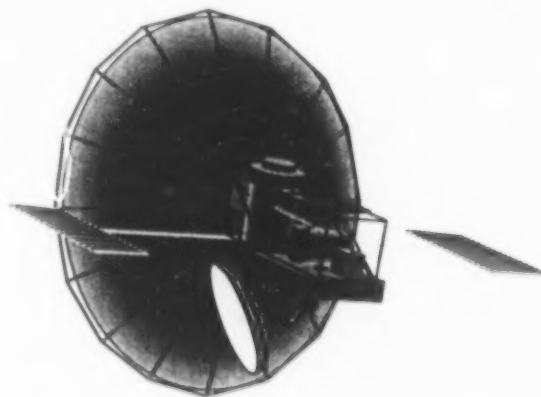
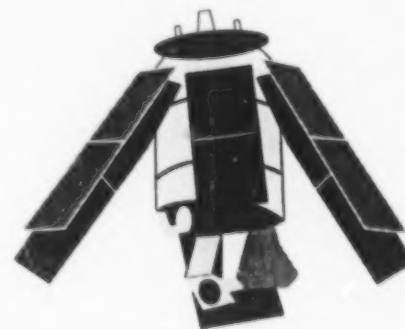
- * Construct a time line illustrating some of history's worst weather disasters.

or

- * Construct a time line showing the development of weather forecasting discoveries.

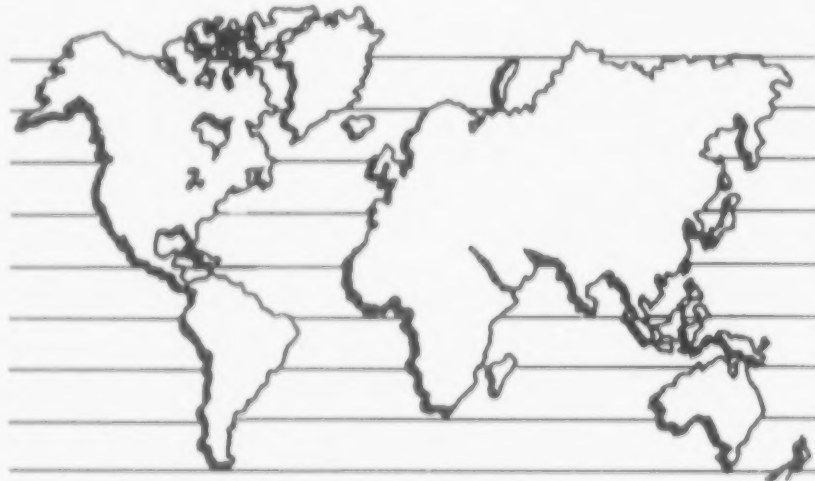
or

- * Construct a time line showing the development of weather detecting instruments.



9. Mapping

- * Use an outline map of the world to illustrate locations of at least twelve famous storms or other weather phenomena. Include a brief description of at least six of them. *or*
- * Use an outline map of the world to show the origins of at least twelve of the following regional weather terms: *Alberta Clipper, Aleutian low, Boulder wind, Alaskan winds, Arctic air, Azores-Bermuda High, Arctic sea smoke, Bane of Boulder, Barrier winds, Catalina eddy, Chinook, Chocolatero, Chololata north, Coromell, Collada, Denver cyclone, Hudson Bay High, Intermountain High, Palousers, Santa Ana, Sonora, Texas Low, Wasatch winds, Washoe zephyr, West Virginia High.* Explain at least six of the terms. *or*
- * Listen to a radio weather report for your local area. Use meteorological symbols and draw a weather map interpreting the report.



10. Life in a Storm

- * Choose a famous storm in history and write a newspaper account of the storm. Detail how the storm affected daily life.

or

- * Write a dialog for a hurricane, tornado, or flood victim as she or he might respond to a reporter's questions.

or

- * Write a few pages from the diary of a hurricane or flood victim.



11. Natural Disasters

- * Predict the demise of plants after a natural disaster. In the event of a flood, do large trees survive? If not, what plants do survive? Are some plants more tolerant of excess water? What adaptations allow for their survival? Will the nonsurviving species of plants return later when conditions improve? If possible, collect data and analyze it to answer these questions.

or

- * Form a hypothesis about what happens to nonhuman animal life during a natural disaster. How might you research your hypothesis?



12. Weather Legends

Find legends about wind or weather. What views do other cultures have about storms? What superstitions still exist about weather phenomena? How are some cultural practices tied to the weather of the region?

* Report your findings in a booklet or presentation.



13. Weather Education

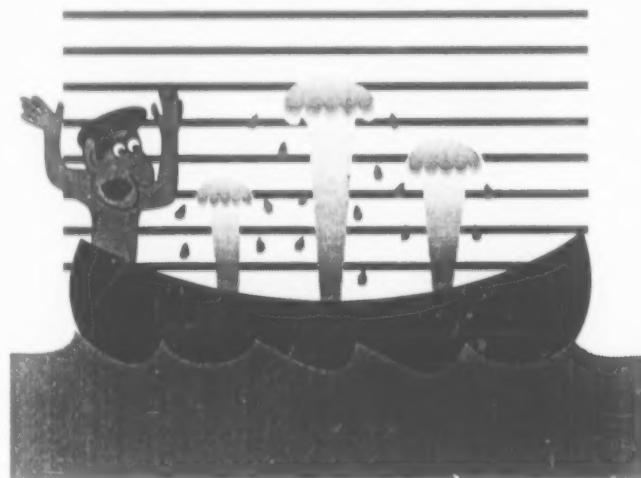
- * Choose one weather topic and search through three encyclopedias, either CD-ROM or book. Compare the encyclopedias to one another for complete coverage of the topic. Could you justify to another person the use of one encyclopedia over another on your chosen topic? Explain why or why not.

or

- * Write an educational pamphlet for the public on tornado or hurricane safety.

or

- * Make a chart of human risks associated with each main type of weather disaster. Evaluate the risks associated with each type.

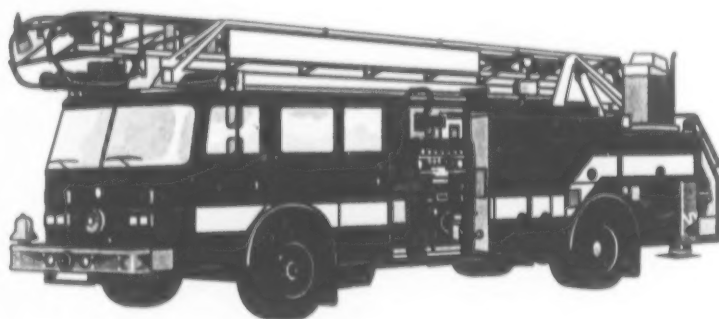


14. Make Plans

- * Construct a plan for city evacuation in the event of a hurricane. Then role-play the evacuation for a hurricane.

or

- * Pretend you are the federal government employee assigned to determine the safety of products that have been in a flood. Go through your room in your house and make a list of items that probably would have to be destroyed if the water level was two feet high.



15. Weather Games

- * Create a board game about weather and play it with friends.

or

- * Write and play a question-and-answer game like Jeopardy using "The Weather" as a category.

or

- * Present weather skits to the class and have people guess what types of weather are being enacted.



16. Careers

- * Interview your local radio, TV, or newspaper meteorologist. Tape record your interview. *or*
- * Make a list of careers that are depend on the weather. Rank them from the "most affected" to "least affected." In which career would you be most interested? Why? *or*
- * Using videotapes of storms available from your weather station, use the pause feature and note minute-by-minute changes within the environment as the storm proceeds. Write a narration for the video detailing these environmental changes.

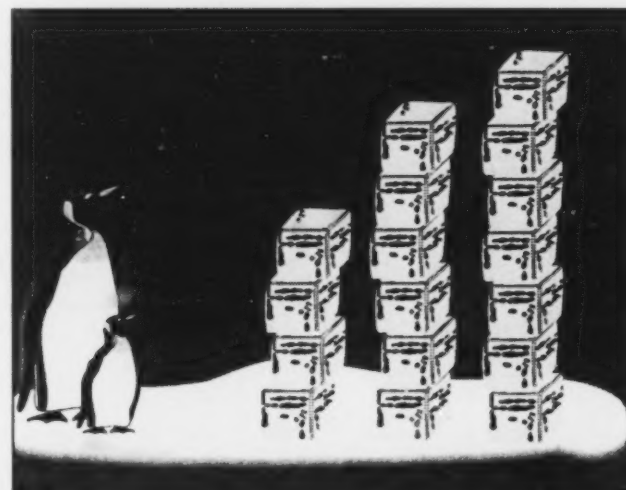


17. Collecting Data

- * Make some weather instruments. You can easily make a simple barometer, thermometer, sling psychrometer, rain gauge, and anemometer. Compare data collected with your homemade versions with the data reported by the weather service.

or

- * Keep a weather journal for one month, taking at least two major data collections each day, preferably at 7:00 A.M. and 7:00 P.M.). Write a column for sky coverage, temperature, humidity, barometric pressure, wind direction and speed, amount of precipitation, and any special weather phenomena observed that day. Compare the data you collect with that of the local newspaper. At the end of one month, analyze your data collection. How could you improve on your accuracy?

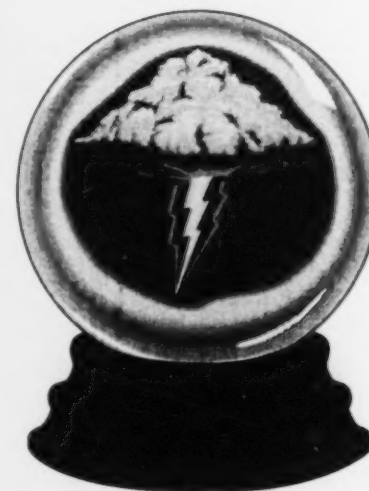


18. Unusual Weather

- * Research and give an oral presentation on any of these weather phenomena: snow rollers, sea smoke, virga, or halos.

or

- * Investigate unique weather terms. Report orally on their meaning and the origin of each term. A few examples might be Haboob, Cow-killer, Dog days, backing wind, gully-washer, and plow wind. You could make up your own list of unique weather terms based on observations you make about the weather around you.



19. Construction

- * View a videotape of the Tacoma Narrows Bridge (also known as "Galloping Gertie") and construct a bridge using soda straws and straight pins. Then make a list of all the weather conditions you can think of that might affect the efficiency of your bridge. What might engineers do to minimize effects of weather on bridges? You might interview a civil engineer and ask her that question.

or

- * Find another human construction that is greatly affected by weather (such as a very tall building in high winds or roads during ice storms). What kinds of factors must engineers take into account? How would you build the structure to withstand the weather? Make a model as an example of a well-constructed road, building, or other construction.



20. Debate

Present a round-table discussion or debate on one of these topics:

- * People should not engage in artificial weather practices such as cloud seeding.
- * People should not be allowed to live within a certain minimum distance from rivers that are known to flood.
- * People should...(come up with your own).



Appendix

Solution to Word Search

Q	F	T	J	B	E	H	C	N	A	L	A	V	A	D	P	R	K	D	S
T	H	M	T	S	H	O	W	E	R	S	U	W	O	E	S	C	R	Q	B
V	T	T	Z	F	Y	A	T	M	S	R	O	B	X	R	A	Z	V	W	
C	Y	H	N	M	Q	J	E	B	D	E	L	R	M	O	Z	Q	N	R	F
G	E	E	Q	V	E	L	C	R	A	F	T	C	V	Z	H	H	B	S	Q
X	F	R	M	E	Y	R	O	M	M	R	K	E	I	C	G	A	O	W	J
E	X	M	P	M	C	U	T	K	R	E	O	L	O	N	Y	Q	I	H	F
X	W	O	U	R	G	I	N	C	V	O	B	M	I	R	R	R	R	L	Z
G	M	M	K	H	E	Q	X	U	U	X	T	T	E	E	O	A	K	P	W
J	B	E	T	E	U	C	D	J	Y	M	S	S	T	T	O	L	X	N	Y
F	I	T	R	M	N	S	I	T	I	A	U	E	R	D	E	G	O	H	W
R	M	E	B	L	N	A	L	P	C	U	M	L	A	E	W	R	S	G	K
X	R	R	G	O	Z	A	C	E	I	O	E	N	O	U	D	D	V	Q	Y
A	J	Y	W	O	M	O	R	I	M	T	R	D	J	N	U	N	I	G	I
U	A	N	U	D	E	O	W	R	R	O	A	V	D	O	I	D	U	I	J
W	E	Q	J	E	F	M	E	M	T	R	W	T	L	Z	R	M	G	H	S
F	P	V	I	U	D	N	V	W	U	L	U	C	I	Y	I	D	B	O	T
P	N	D	X	V	A	L	T	G	L	U	Q	H	D	O	I	U	V	U	B
F	K	M	E	S	O	C	Y	C	L	O	N	E	L	I	N	N	M	P	S

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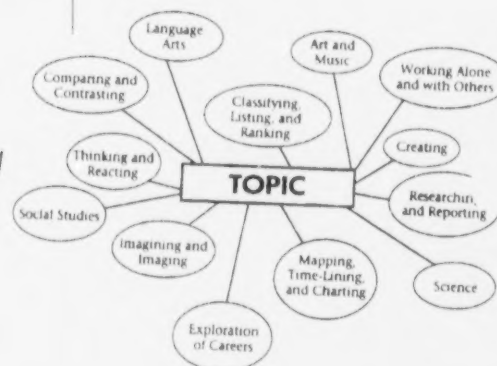
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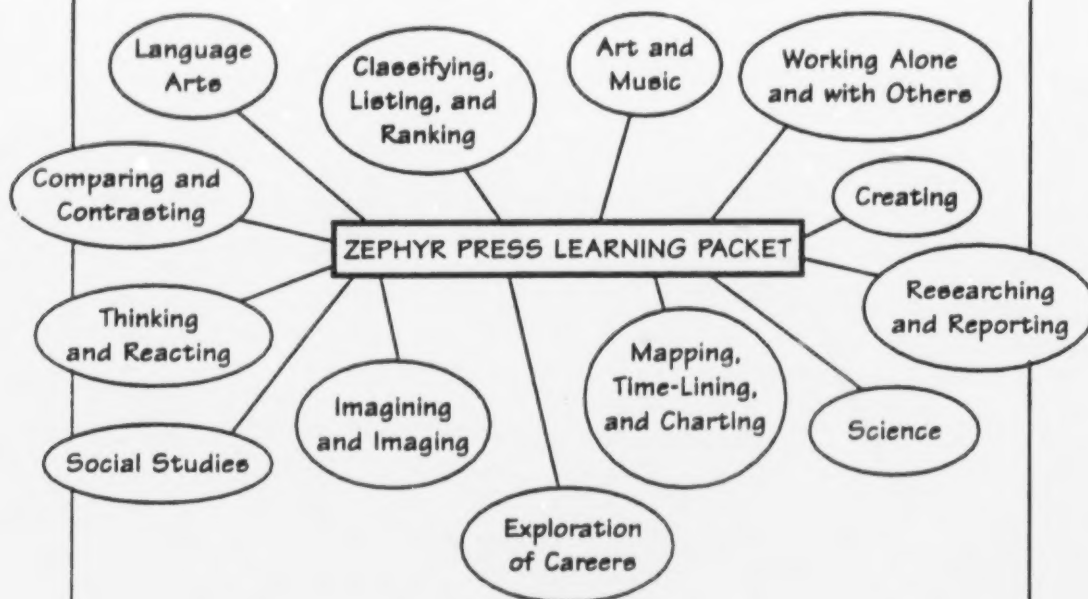
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